AMENDMENT

To: Examiner of the Patent Office

July 20, 2004

1. Identification of the International Application
PCT/JP03/11935

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4. Object of Amendment
Specification and Claims

5. Content of Amendment
(1) Specification p.4, Lines 19,
"a polarized light from an illuminating light source" is to be amended to "a polarized light from an illuminating light source and a polarizer".

(2) Specification p.4, Lines 27 - 28,
"of said matrix type liquid crystal device" is to be amended to "of said matrix type liquid crystal device aligned in the position corresponding to each microlens".

(3) Specification p.4, Line 30 - 31,

"each pixel of said matrix type liquid crystal device" is to be amended to

"each neighboring pixel of said matrix type liquid crystal device".

(4) Specification p.4, Lines 32 - 34,

"controls the polarization directions of the lights transmitted through each pixel of the matrix type liquid crystal device so that they are made mutually orthogonal." is to be amended to

"controls so that the polarization directions of the light transmitted through each neighboring pixel of the matrix type liquid crystal device are made mutually orthogonal, and makes a plurality of foci with the lights the polarization directions of which are mutually orthogonal onto an object to be observed.".

(5) Specification p.5, Lines 17 - 18,

"a polarized light from an illuminating light source" is to be amended to "a polarized light from an illuminating light source and a polarizer".

(6) Specification p.5, Line 29 - 30,

"of said first matrix type liquid crystal device" is to be amended to

"of said first matrix type liquid crystal device aligned in the position corresponding to each microlens".

(7) Specification p.5, Lines 33,

"of said second matrix type liquid crystal device" is to be amended to

"of said second matrix type liquid crystal device aligned in the position corresponding to each microlens".

(8) Specification p.5, Line 34 – p.6, Line 2,

"as well as controls the polarization direction of the light

transmitted through each pixel of the first and the second matrix type liquid crystal devices using said first and second liquid crystal control subpart." is to be amended to
"as well as controls the polarization direction of the light transmitted through each pixel of the first matrix type liquid crystal device using the first liquid crystal control subpart, and the first liquid crystal control subpart controls polarization directions of the lights transmitted through each neighboring pixel of the first matrix type liquid crystal device to be mutually orthogonal, thereby making a plurality of foci with the lights the polarization directions of which are mutually orthogonal onto an object to be observed, and controls the polarization direction of the light transmitted through each pixel of the second matrix type liquid crystal device using the second liquid crystal control subpart, and the second liquid crystal control part controls polarization directions of the lights transmitted through each neighboring pixel of the second matrix type liquid crystal device to be mutually orthogonal, thereby making a plurality of foci with the lights the polarization directions of which are mutually orthogonal onto an imaging device."

(9) Specification p.6, Lines 3 - 9,

"the first liquid crystal control subpart of the inlet light optical part may preferably control the direction of polarized light passing through each pixel of the first matrix type liquid crystal device to be made mutually orthogonal. Also preferably, the second liquid crystal control subpart of the detective optical part may control the direction of polarized light passing through each pixel of the second matrix type liquid crystal device to be made mutually orthogonal. Also," is to be deleted.

(10) Specification p.7, Line 24,

After "may be applied onto each pixel by a plurality of modulated frequency." is to be added
"Also preferably, the conversion of amplitude modulation signals of the reflected or fluorescent light from said object to be observed to

frequency signals is operation-processed by high speed Fourier transform."

(11) Claims p.36, Claim 1, Lines 2 - 3,

"a polarized light from an illuminating light source" is to be amended to "a polarized light from an illuminating light source and a straight polarizer".

(12) Claims p.36, Claim 1, Lines 12 - 13,

"matrix type liquid crystal device" is to be amended to
"matrix type liquid crystal device aligned in the position corresponding to said each microlens".

(13) Claims p.36, Claim 1, Line 15,

"each pixel of the matrix type liquid crystal device" is to be amended to
"each neighboring pixel of the matrix type liquid crystal device".

(14) Claims p.36, Claim 1, Lines 17 - 19,

"controls polarization directions of the lights transmitted through each pixel of a matrix type liquid crystal device so that they are made mutually orthogonal." is to be amended to
"controls polarization directions of the lights transmitted through each neighboring pixel of the matrix type liquid crystal device so that they are made mutually orthogonal, and makes a plurality of foci with the lights the polarization directions of which are mutually orthogonal onto an object to be observed.".

(15) Claims p.36, Claim 3, Lines 2 - 3,

"a polarized light from an illuminating light source" is to be amended to
"a polarized light from an illuminating light source and a straight polarizer".

(16) Claims p.37, Claim 3, Lines 15 - 16,

"said first matrix type liquid crystal device" is to be amended to "said first matrix type liquid crystal device aligned in the position corresponding to said each microlens".

(17) Claims p.37, Claim 3, Lines 18 – 20,

"fluorescent light passing through said second microlens array from each microlens array to each pixel of said second matrix type liquid crystal device" is to be amended to
"fluorescent light passing through said second microlens array from each microlens array to each pixel of said second matrix type liquid crystal device aligned in the position corresponding to each microlens".

(18) Claims p.37, Claim 3, Lines 21 – 24,

"controls the polarization direction of the light transmitted through each pixel of said first and second matrix type liquid crystal devices using said first and second liquid crystal control subpart." is to be amended to
"controls the polarization direction of the light transmitted through each pixel of the first matrix type liquid crystal device using the first liquid crystal control subpart, and said first liquid crystal control subpart controls polarization directions of the lights transmitted through each neighboring pixel of said first matrix type liquid crystal device to be mutually orthogonal, thereby making a plurality of foci with the lights the polarization directions of which are mutually orthogonal onto an object to be observed, and controls the polarization direction of the light transmitted through each pixel of said second matrix type liquid crystal device using the second liquid crystal control subpart, and said second liquid crystal control subpart controls polarization directions of the lights transmitted through each neighboring pixel of said second matrix type liquid crystal device to be mutually orthogonal, thereby making a plurality of foci with the lights the polarization directions of which are mutually orthogonal onto an imaging device.".

(19) Claims p.37, Claim 4 is to be deleted.

(20) Claims p.37, Claim 5 is to be deleted.

(21) Claims p.41, Claim 19, Line 7,
"claims 1 to 18" is to be amended to "claims 7 to 18".

(22) Claims p.41, Claim 19, Line 1 - 2,
"The method of measuring fluorescence from a microarray substrate" is to be amended to
"The method of measuring fluorescence of a microarray substrate".

(23) Claims p.41, Claim 22, Line 6,
"claims 1 to 18" is to be amended to "claims 7 to 18".

(24) Claims p.42, Claim 24 is to be added as follows,
"24. The method of measuring fluorescence of a microarray substrate by a confocal microscope using liquid crystal, characterized in that for the fluorescence measurement of a microarray substrate with a fluorescent material as a selective marker given in advance, the fluorescence from said fluorescent material is observed by using a confocal microscope using liquid crystal as set forth in any one of claims 1, 2, 3, and 6.".

(25) Claims p.42, Claim 25 is to be added as follows,
"25. The method of measuring fluorescence of a microarray substrate by a confocal microscope using liquid crystal as set forth in claim 24, characterized in that said microarray substrate contains a minute amount of DNA or a biological material.".

(26) Claims p.42, Claim 26 is to be added as follows,
"26. The method of measuring fluorescence of a microarray substrate by a confocal microscope using liquid crystal as set forth in claim 24 or 25, characterized in that said microarray substrate is a DNA chip.".

(27) Claims p.42, Claim 27 is to be added as follows,

"27. The method of measuring polarized light by said confocal microscope, characterized in that for measuring polarized light from the reflected or fluorescent light from an object to be observed, the polarized light from said object to be observed is measured by using a confocal microscope using liquid crystal as set forth in any one of claims 1, 2, 3, and 6."

(28) Claims p.42, Claim 28 is to be added as follows,

"28. The method of measuring polarized light by a confocal microscope using liquid crystal as set forth in claim 27, characterized in that in the liquid crystal matrix of said confocal microscope using liquid crystal, the polarized light from said object to be observed is measured by rotating said polarized light by 180 degrees.".

6. List of Attached Documents

(1) Specification p.4, p.4/1, p.5, p.5/1, p.6, p.7, p.7/1

(2) Claims p.36 to p.42

observation by scanning in-plane on the sample stage. Although the time for scanning is made shorter than the case of monofocus of the multi-confocal microscope of a conventional example 1, the scanning is necessary to observe wide range, thereby a real time observation of fluorescence or the like is difficult.

Disclosure of the Invention

[0015] The object of the present invention is, referring to the above-mentioned problems, to offer a confocal microscope using liquid crystal device, the method of fluorescent measurement of microarray substrates by the confocal microscopy using liquid crystal device, and to a method of polarized light measurement by the confocal microscopy using liquid crystal device, which are of high sensitivity, excel in resolution in the horizontal and the depth directions, and are capable of dynamic observation in a wide range.

[0016] In order to solve the problems mentioned above, a confocal microscope using liquid crystal in accordance with the present invention is a confocal microscope comprising:an inlet optical part to let a polarized light from an illuminating light source and a polarizer onto an object to be observed via a beam splitter, a matrix type liquid crystal device provided with a microlens array on its top part, and an objective lens; a light detecting part including an imaging device to detect a reflected or a fluorescent light from the object to be observed via said beam splitter and lens; and a control part including a liquid crystal control subpart to control each pixel of said matrix type liquid crystal device, characterized in that it transmits the light passing through said microlens array from each microlens to each pixel of said matrix type liquid crystal device aligned in the position corresponding to each microlens, and makes a plurality of foci on said object to be observed by said objective lens, as well as controls so that the polarization directions of the light transmitted through each neighboring pixel of the matrix type liquid crystal device are made mutually orthogonal, and makes a plurality of foci with the lights the polarization directions of which are mutually orthogonal onto an object to be observed.

[0017] In the above-mentioned aspect, a polarizer is preferably located